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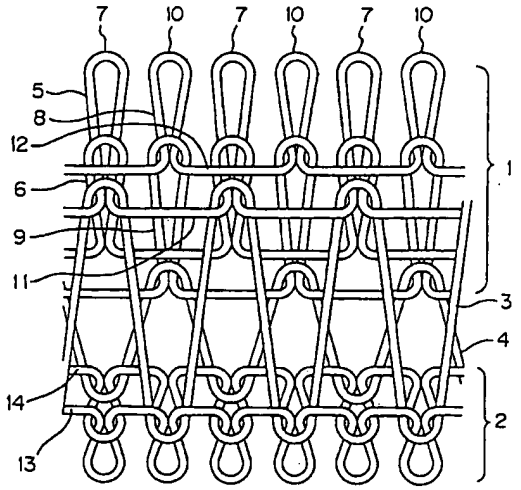
(54) Resilient material comprising warp knitted fabrics and warp knitted composite fabric.

(57) A warp knitted composite fabric is provided comprising a frontal layer (1) of a warp knitted fabric and a rear layer (2) of another warp knitted fabric, where the two layers are arranged vis-a-vis at a given distance (W). The layers (1, 2) are coupled by a network of coupling yarns (3, 4) which are more firm and resilient than the yarns forming the front and rear layers (1, 2). In addition, the frontal layer of knitted fabric can contain a pile (25) to produce a nap (26) on the surface thereof.

Fig.1



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This invention r lates to a r silient material comprising warp knitted fabrics and warp knitted composite fabric comprising two fabric layers and designed for use as a material for decorating both the interior and the exterior of buildings, car, furniture, bags or the like.

While spongy elastic PVC sheets are popularly used for decorating the interior and the exterior of buildings, cars, furniture and bags, such sheets are not recyclable and hence can give rise to environmental problems. A Raschel fabric which is a wool knitted fabric has been proposed as an alternative to a spongy elastic PVC sheet but it is longitudinally not satisfactorily expandable and, what is worse, costly. It will become even more costly when it is processed for napping and hence less acceptable as an alternative to the spongy elastic PVC sheet.

It is therefore an object of the present invention to provide at relatively low cost a warp knitted fabric made of recyclable yarns and having a satisfactory expandability both longitudinally and laterally and an excellent nappy touch such that it may be suitably used as an interior or exterior material in a variety of applications.

According to the present invention, the above object of the invention is achieved by providing a resilient material comprising a frontal layer of a warp knitted fabric and a rear layer made of another warp knitted fabric, said warp knitted fabrics being arranged vis-a-vis with a given distance separating them from each other and coupled by a network of coupling yarns, said coupling yarns being more firm and resilient than the yarns of the frontal and rear layers, said coupling yarns including S-twist yarns and Z-twist yarns arranged alternately.

Since the pair of warp knitted fabrics of a resilient material according to the invention are arranged in two layers,a frontal layer and a rear layer, that are coupled together by a network of coupling yarns including S-twist yarns and Z-twist yarns arranged alternately, said coupling yarns being more firm and resilient than the yarns of the two warp knitted fabrics in order to constantly maintain the distance between the two warp knitted fabrics equal to the distance between any two adjacent interlocking points of each coupling yarn, the oppositely directed torques of the coupling yarns generated by the oppositely twisted yarns makes the network of coupling yarns rigid enough to constantly separate the frontal and rear layers such that, if the resili nt mat rial is pressed repeatedly to make the two layers contact with each oth r, they may be separated again by th network of coupling yarns to give th r silient material a remarkable resili ncy.

Additionally, the resilient material according to the invention shows a satisfactory expandability both in the longitudinal and the lateral dir ctions.

The resilient material is also recyclable and hence friendly to the environment if it is made of polyester yarns.

Finally, the thickness of a resilient material according to the invention can be controlled by modifying the distance between any two adjacent interlocking points of each coupling yarn arranged between the frontal and rear warp knitted fabric layers. A resilient material has a high degree of processibility in terms of dying, laminating the rear layer, bonding an additional layer thereto and so on in order to broaden the scope of application of the material for decorating the interior and the exterior of buildings, cars, furniture, bags and the like.

According to the present invention, a warp knitted composite fabric comprising a frontal layer of a warp knitted fabric is also provided comprising a frontal layer of a warp knitted fabric and a rear layer made of another warp knitted fabric, said warp knitted fabrics being arranged vis-a-vis with a given distance separating them from each other and coupled by a network of coupling yarns, said warp knitted fabric of the frontal layer containing pile to produce a nap on the surface, said coupling yarns including S-twist yarns and Z-twist yarns arranged alternately.

Since the pair of warp knitted fabrics of a warp knitted composite fabric according to the invention are arranged in two layers, a frontal layer and a rear layer, that are coupled together by a network of coupling yarns including S-twist yarns and Z-twist yarns arranged alternately, the oppositely directed torques of the coupling yarns generated by the oppositely twisted yarns makes the network of coupling yarns rigid enough to constantly separate the frontal and rear layers such that, if the composite fabric is pressed repeatedly to make the two layers contact with each other, they may be separated again by the network of coupling yarns to give the composite fabric a remarkable resiliency.

The warp knitted composite fabric according to the invention shows a satisfactory expandability both in the longitudinal and the lateral directions.

Additionally, the warp knitted fabric of the frontal layer of the composite fabric contains pile providing an excellent appearance and an agreeable touch and can be processed to provide a variety of different appearances and touches by raising and/or shirring.

The thickness, r siliency and other properties of a warp knitted composite fabric according to the invention can be modified by controlling the firmness and the length of each yarn of the coupling network and sel cting the number of interlocking points to be formed by coupling yarns per unit area

of the composite fabric.

Finally, the warp knitted composite fabric is recyclable and hence friendly to the environment if it is made of polyester yarns.

Now, the present invention will be described in greater detail by referring to the accompanying drawings that illustrate preferred embodiments of the invention.

Fig. 1 is an enlarged schematic partial view of a preferred embodiment of resilient material according to an embodiment of the present invention.

Fig. 2 is an enlarged schematic partial sectional view of the embodiment of Fig. 1 as seen from a lateral side of Fig. 1.

Fig. 3 is an enlarged schematic partial view of a preferred embodiment of a warp knitted composite fabric according to the present invention.

Fig. 4 is an enlarged schematic partial sectional view of the embodiment of Fig. 3 as seen from a lateral side of Fig. 3.

Referring to Figs. 1 and 2, it is seen that the frontal layer 1 of a warp knitted fabric and the rear layer 2 of another warp knitted fabric of the embodiment are coupled by a network of coupling yarns with a distance W separating them from each other, said coupling yarns including S-twist coupling yarns 3 and Z-twist coupIng yarns 4 arranged alternately.

While the frontal layer 1, the rear layer 2 and the network of coupling yarns 3 and 4 may appear to be laid on a same plane in Fig. 1, it may be understood from Fig. 2 that the warp knitted fabric of the frontal layer 1 and that of the rear layer 2 are arranged in parallel with a distance W separating them from each other and are coupled together by coupling yarns.

The warp knitted fabric 1 of the frontal layer of the illustrated embodiment has wales 7 formed by polyester yarns 5 and 6 and wales 10 formed by yarns 8 and 9 identical with yarns 5 and 6, said wales 7 and 10 being alternatively arranged, the portion of the fabric formed by yarns 5 and 6 or wales 7 and that formed by yarns 8 and 9 or wales 10 being coupled together by means sinker loops 11 and 12 to produce a fabric entity.

The warp knitted fabric 2 of the rear layer of the illustrated embodiment is formed by polyester yarns 13 and 14.

The frontal layer 1 and the rear layer 2 of warp knitted fabric are coupled together by coupling yarns 3 and 4 as described above and it should be noted that the coupling yarns 3 and 4 are more firm and resilient than yarns 5, 6, 8, 9, 13 and 14 of the warp knitted fabrics of the two layers 1 and 2 that th coupling yarns 3 are S-twist yarns while the coupling yarns 4 are Z-twist yarns.

Referring to Figs. 1 and 2, ach S-twist coupling yarn 3 is hooked to the n ck of the s cond yarn 6 of a wale 7 of the warp knitted fabric of the frontal layer I and then to the neck of th second yarn 13 of an adjacent wale IO of the warp knitted fabric of the rear layer whereas each Z-twist coupling yarn 4 is hooked to neck of the fourth yarn 9 of a wale 10 of the warp knitted fabric of the frontal layer 1 and then to the neck of the first yarn 14 of an adjacent wale 7 of the warp knitted fabric of the rear layer 2. However, the mode of stitch of the coupling yarns 3 and 4 are not limited to the above described one and any other modes may be permissible as long as the coupling yarns 3 and 4 are interlocked with every every other wales of the warp knitted fabrics of the frontal and rear layers 1 and 2.

While any appropriate material other than polyester may be used for the yarns and the coupling yarns of a resilient material according to the invention so long as it is friendly to the environment, although polyester is recommendable from the view point of recycling.

The warp knitted fabrics of a resilient material according to the invention may have stitches other than those shown in Fig. 1. Thus, the diameter of each of the coupling yarns 3 and 4, the number of interlocking points of coupling yarns per unit area and the distance between two interlocking points of each coupling yarn for separating the warp knitted fabrics 1 and 2 of a resilient material according to the invention may be appropriately selected to meet the requirements posed on the material.

Referring to Figs. 3 and 4, it is seen that the frontal layer 21 of a warp knitted fabric and the rear layer 22 of another warp knitted fabric of the second embodiment of the invention are coupled by a network of coupling yarns with a distance W separating them from each other, said coupling yarns including S-twist coupling yarns 23 and Z-twist coupling yarns 24 arranged alternately.

Said warp knitted fabric of the frontal layer 21 contains pile yarns 25 to produce a nap 26 on the surface of the frontal layer 21.

Note that the marginal sections of both of the warp knitted fabrics 21 and 22 are now shown in Fig. 1.

While the frontal layer 21, the rear layer 22 and the network of coupling yarns 23 and 24 may appear to be laid on a same plane in Fig. 1, it may be understood from Fig. 2 that the warp knitted fabric of the frontal layer 21 and that of the rear layer 22 are arranged in parallel with a distance W separating them from each other and are coupled together by coupling yarns.

Th warp knitted fabric of the frontal lay r 21 comprises wales 29 formed by polyester yarns 27, 28, a pile yarn 30 and another polyester yarn 31 made of a material same as that of the yarns 27 and 28, said pile yarn 30 and said polyester yarn

31 constituting a component yarn 32, and th pil yarn 30 is outwardly extended between two adjacent wales 29, 29 to produce a filament of pile 26.

The warp knitted fabric of the rear layer 22, on the other hand, comprises wales of 25 formed by polyester yarns 33, 34 made of a material same as that of the yarns 27 and 28. The frontal layer 21 and the rear layer 22 are coupled by a network of S-twist coupling yarns 23 and Z-twist coupling yarns 24 arranged alternately such that the two layers are arranged in parallel with each other and separated by a distance W.

The coupling yarns 23 and 24 are preferably made of a polyester material that is more firm and resilient than the material of the yarns 27, 28 33 and 34 because the distance W separating the frontal layer 21 and the rear layer 22 can be maintained only by the firmness and the resiliency of the coupling yarns 23 and 24.

Filaments of pile 26 give rise to a nap on the warp knitted composite fabric when they are processed for raising and/or shirring. Note that the produced warp knitted composite fabric may be sufficiently nappy without requiring a rising and/or shirring process if filaments of pile are densely arranged. If such is the case, the warp knitted composite fabric may show an outstanding resiliency.

It should be noted that a warp knitted composite fabric according to the invention may have stitches different from those of the above described embodiment shown particularly in Fig. 1 so long as it comprises warp knitted fabrics and any appropriate material other than polyester may be used for the yarns and the coupling yarns so long as it is friendly to the view point of recycling.

As described above in detail, since resilient material according to the first invention comprises a frontal layer of a warp knitted fabric and a rear layer of another warp knitted fabric that are coupled by coupling yarns that are more firm and resilient than the yarns of the two layers and the coupling yarns include S-twist coupling yarns and Z-twist coupling yarns arranged alternately, the frontal and rear layers of warp knitted fabric are held vis-a-vis and separated from each other by a distance corresponding to the length between any two interlocking points of each coupling yarn.

Additionally, since the coupling yarns include S-twist coupling yarns and Z-twist coupling yarns arranged alternately, the oppositely directed torques of the coupling yarns generated by the oppositely twisted yarns makes the n twork of coupling yarns rigid nough to constantly separate the frontal and rear lay rs. Thus, if the r sili nt material is pr ssed repeatedly to make th two lay rs contact with each other, they may be separated again by the network of coupling yarns to giv th resilient material a r markabl resiliency.

Additionally, a resilient material according to the inv ntion shows a satisfactory expandability both in the longitudinal and the lateral directions.

Furthermore, the thickness and the resiliency of a resilient material can be controlled by modifying the diameter of each of the coupling yarns, the number of interlocking points of coupling yarns per unit area and the distance between two interlocking points of a coupling yarn for separating the warp knitted fabrics.

Finally, a resilient material according to the invention provide a high degree of processibility in terms of dying, laminating the rear layer, bonding an additional layer thereto and so on in order to broaden the scope of application of the material. A resilient material according to the invention is recyclable and hence friendly to the environment if it is made of polyester yarns.

As described above in detail, since a warp knitted composite fabric comprises a frontal layer of a warp knitted fabric and a rear layer of another warp knitted fabric that are coupled together by S-twist coupling yarns and Z-twist coupling yarns arranged alternately, the two layers are constantly separated from each other by a distance corresponding to the length between any two adjacent interlocking points of each coupling yarn such that the warp knitted composite fabric may show an excellent resiliency.

Additionally, since the warp knitted fabric of the surface layer of a warp knitted composite fabric contains pile particularly on the surface thereof, the composite fabric may be napped by rising and/or shirring. Then, the coupling yarns of the composite fabric may be partly drawn outside by the raising operation to further improve the ability of the composite fabric to maintain the distance of its two warp knitted fabrics.

Still additionally, the thickness, resiliency and other properties of a warp knitted composite fabric can be modified by controlling the firmness and the length of each yarn of the coupling network and selecting the number of interlocking points to be formed by coupling yarns per unit area of the composite fabric.

Finally, a warp knitted composite fabric according to the invention provides a high degree of processibility in terms of dying, laminating the rear layer, bonding an additional layer thereto and so on in order to broaden the scope of application of the composite fabric as a material for decorating the interior and the exterior of buildings, cars, furniture, bags and th lik . Th pile contain d in th composite fabric gives the latter an xcellent appearanc and an agr eable touch.

Claims

1. A resilient material characterized in that it comprises a frontal layer (1, 21) of a warp knitted fabric and a rear layer (2, 22) made of another warp knitted fabric, said warp knitted fabrics being arranged vis-a-vis with a given distance (W) separating them from each other and coupled by a network of coupling yarns (3, 23; 4, 24), said coupling yarns being more firm and resilient than the yarns of the frontal and rear layers (1, 21; 2, 22), said coupling yarns including S-twist yarns (3, 23) and Z-twist yarns (4, 24) arranged alternately.

2. A warp knitted composite fabric characterized in that it comprises a frontal layer (1, 21) of a warp knitted fabric and a rear layer (2, 22) made of another warp knitted fabric, said warp knitted fabrics being arranged vis-a-vis with a given distance (W) separating them from each other and coupled by a network of coupling yarns (3, 23; 4, 24), said warp knitted fabric of the frontal layer containing pile (25) to produce a nap (26) on the surface, said coupling yarns including S-twist yarns (3, 23) and Z-twist yarns (4, 24) arranged alternately.

Fig.1

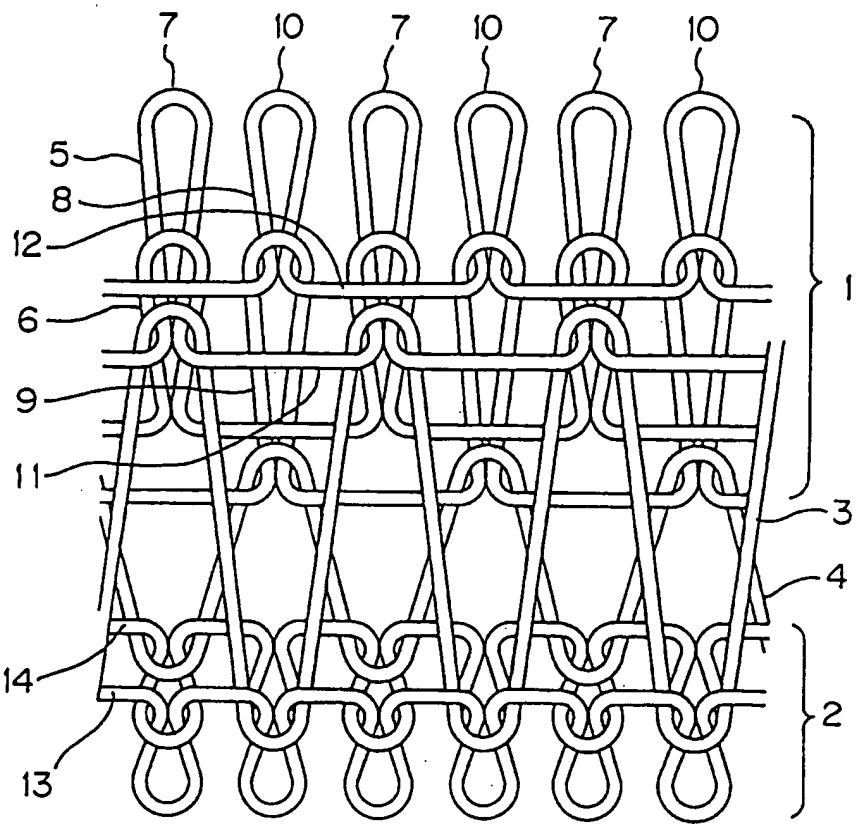


Fig.2.

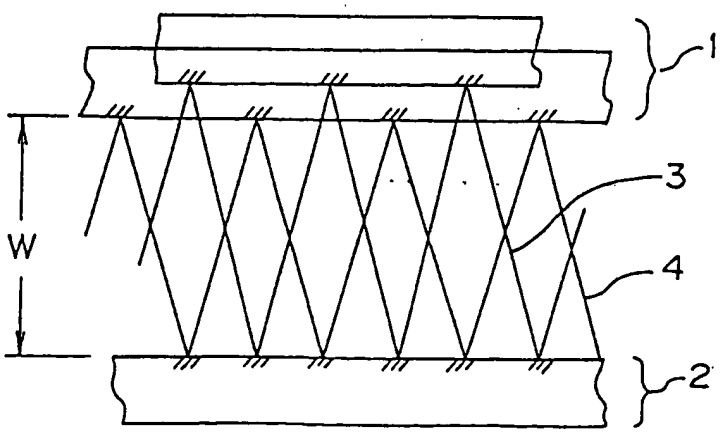


Fig.3

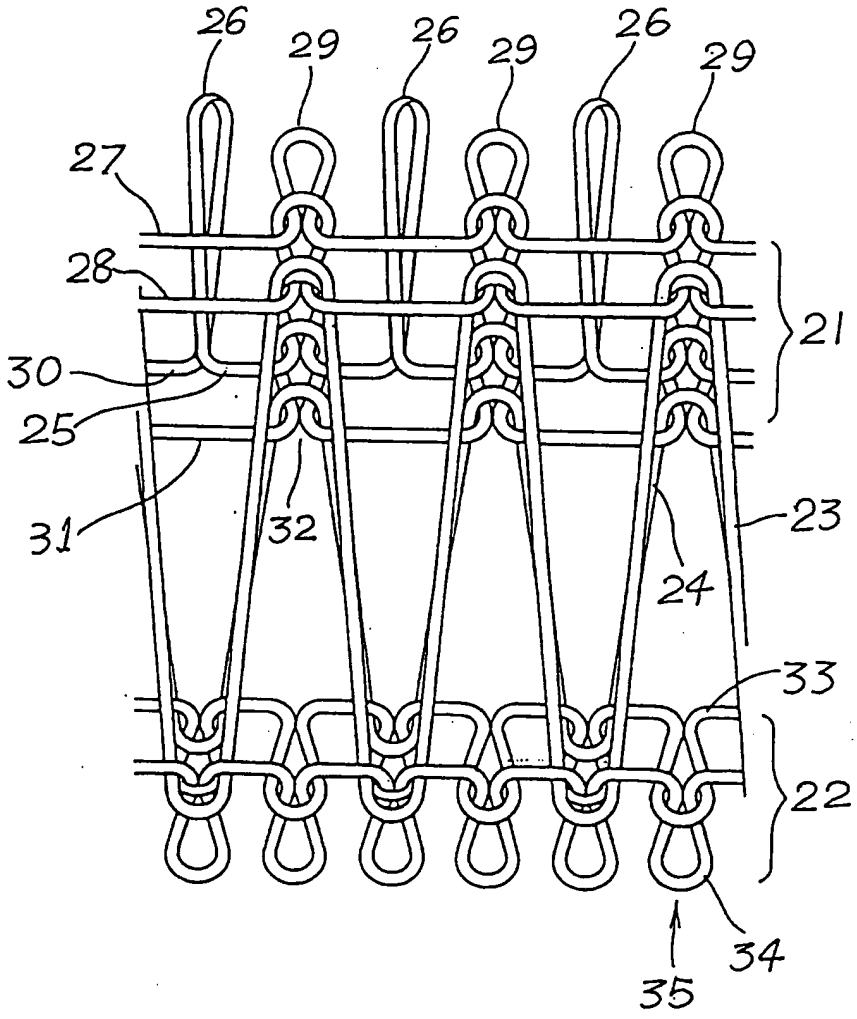
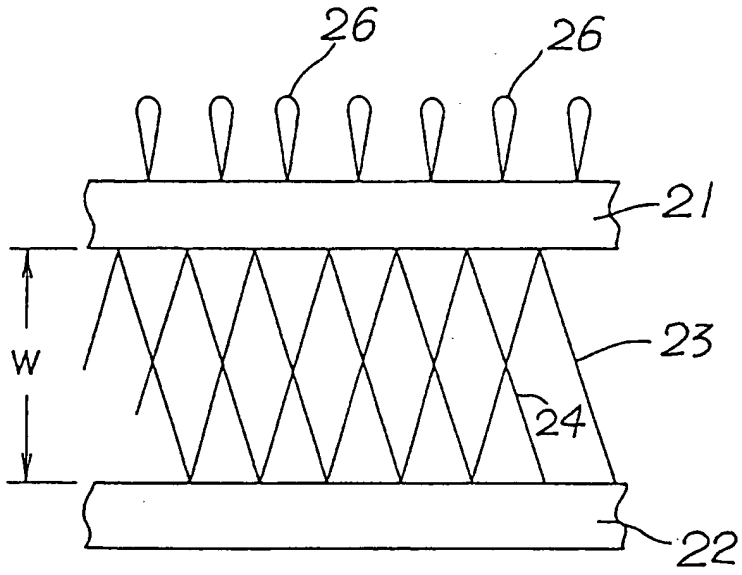


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 9918

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	DE-A-31 39 402 (HOECHST AG) * page 6, line 1 - line 9; figure 1 *	1	D04B21/00
Y	DE-A-25 11 505 (FA. FRITZ MOLL TEXTILWERKE) * page 3, line 16 - page 4, line 4; figure 1 *	1	
A	GB-A-2 009 266 (AB EISER) * page 1, line 115 - line 128; figures 1-6 *	1	
A	FR-A-1 507 442 (JEAN GÜSKEN MASCHINENFABRIK-EISENGIESSEREI) * page 2, right column, line 23 - page 3, left column, line 48; figures 1-3 *	1,2	
A	DE-U-90 16 062 (MÜLLER TEXTIL GMBH)		
A	DE-U-93 02 039 (HOECHST AG)		TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	EP-A-0 339 227 (VORWERK & CO. INTERHOLDING GMBH)		D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 October 1994	Van Gelder, P

CATEGORY OF CITED DOCUMENTS

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